

## Feeding and foraging behaviour of the Laughing Dove *Streptopelia senegalensis* in Lucknow, India

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**Abstract** – The Laughing dove is a resident species and is found all across India. They occur abundantly in Lucknow, Uttar Pradesh. We conducted a gut content analysis and observed their foraging behaviour on the farmlands located on the city outskirts and at granaries and storehouses in the city and on its outskirts between July, 2005 and June, 2006. Among gut contents we were able to identify and quantify grains of wheat, millet and rice along with seeds of sunflower, grass and 10 species of weeds. Among animal matter were ants, termites, spiders and dipteran larvae. Their foraging behaviour matched well with their gut contents and we made 1200 observations on plant matter and 80 observations on animal matter. During nesting period they foraged individually for shorter durations. Presence of roosting sites increased foraging activities.

**Riassunto** – *Dieta e comportamento alimentare della tortora delle palme a Lucknow, India.* La tortora delle palme è sedentaria in tutta l'India, ed è abbondante a Lucknow, nello stato dell'Uttar Pradesh. Abbiamo studiato i contenuti dei loro gozzi, e osservato il comportamento alimentare, nelle aree agricole dell'area urbana e presso granai e magazzini, anch'esse nell'area urbana, tra il luglio 2005 e il giugno 2006. Abbiamo identificato e quantificato, nel contenuto dei gozzi, grani di frumento, miglio e riso, insieme a semi di girasole, graminacee, e dieci specie di infestanti. Formiche, termiti, ragni e larve di ditteri costituiscono la frazione animale. L'analisi del comportamento alimentare, basata su 1200 osservazioni su materiale vegetale, e 80 su animali, si accorda bene con quella della dieta. Durante la stagione riproduttiva il foraggiamento è individuale, ed avviene per tempi più brevi. La vicinanza con i dormitori incrementa le attività alimentari.

### INTRODUCTION

The Laughing dove *Streptopelia senegalensis* is a resident species occurring across West Pakistan, India and Bangladesh. It is widespread in Africa and in some European region. It occurs up to an elevation of 1000 m a.s.l. in Western Himalayas and 1500m of Peninsular Hills in India. In India it is found across the length and breadth of the country up to the southernmost region of Kanyakumari. It occurs abundantly in Lucknow, Uttar Pradesh. It occurs in urban and rural habitats and is seen in fields and grain markets. We set out to conduct a year-long study to ascertain the feeding and foraging behaviour of laughing doves in Lucknow. It is important to determine the food habits of birds since every bird has its own preferential food; a bird species could be beneficial to a crop, harmful to another and neutral to yet another. For example the house sparrow

*Passer domesticus* feeds on insects and is useful to areas where rice is being cultivated since the insects it consumes damage the rice crop.

### FEEDING HABITS

#### Methods

To study the feeding habits of the Laughing dove we decided to conduct gut content analysis on them. 200 Laughing doves were captured in and around Lucknow (26° 55' N, 80° 59' E: 450 meters above sea level), India, between July 2005 and June 2006. They were trapped 30-45 mins after they had fed in fields. They were subjected to non-lethal forced regurgitation technique (Prys-Jones et al 1974). Orally administered emetic 0.1cm<sup>3</sup> of 1% solution of antimony potassium tartrate per 10g of body mass was given to them and they were placed in a dark cage lined with wax paper. In two to three minutes birds regurgitated pellets of partially digested food matter, which were col-

Received 12 April 2008, accepted in revised form  
15 September 2008

lected and preserved for identification. All the samples collected matched well to total crop and stomach contents of collected birds (Rosenberg and Cooper 1990). Qualitative and quantitative analyses of different food items were made for subsequent examination. For qualitative analysis, food items were identified by comparing with items taken in fields at the time of capturing the birds. For quantitative analysis, the volume of food particles was recorded using displacement method. All the trapped birds were subsequently released unharmed upon completion of the study.

All the study was done in Lucknow. The study area for evaluating damage to crops comprised fields of crops located on the outskirts of the city. Study of pestilence to food grains by birds was carried out at grain markets and 12 granaries and storehouses in Lucknow district and on the outskirts. Visual observations of the field crops for damage of ear heads and other types of damage to them were made.

## Results

Among the food items that we were able to identify and quantify in the whole year, grains comprised 30% of the total mass wheat *Triticum aestivum* (11.40% of total mass); millets *Sorghum vulgare* and *Pennisetum typhoides* (12.60% of total mass) and rice *Oryza sativa* (6% of total mass).

Sunflower seeds (*Helianthus annuus*) comprised 10% of total mass and grass seeds comprised 20.50% of the total mass including seeds of *Cynodon dactylon* (9.50% of total mass) and *Andropogon muricatus* (11% of total mass). Seeds of 10 species of weed belonging to 9 families were identified (23.20% of total mass) (Tab. 1).

The insect matter comprised 10% of total mass including ants: *Camponotus* sp. (3% of total mass); termites: *Odontotermes* sp. (2% of total mass); spiders: *Cteniza* sp. (1% of total mass) and *Lycosa* sp. (2% of total mass); dipteran larvae (2% of total mass). Unidentified matter comprised 6.30% of the total mass and comprised both plant and animal matter.

## FORAGING BEHAVIOUR

Along with the study of gut contents, study of foraging ecology also assumes significance. Dhindsa and Toor (1990) found that rice was the principal gut content of three weaver bird *Ploceus* species in Punjab, India. However, subsequent field study revealed that rice grains picked by these birds were left in the store or shed during crop harvest and thus were already wasted. This shows that any study on gut

content analysis should be followed up with foraging ecology study of the same species.

The foraging ecology of some Indian bird species has been studied in cultivated and natural habitats (Dhindsa and Saini 1994). Most of the studies on 13 bird species of agricultural importance in India focused on food preference in captivity and gut content analysis (Mathew 1976, Mathew et al 1980, Dhindsa and Toor 1990, Saini and Dhindsa 1993).

## Methods

We made 1200 observations on plant matter throughout the 12-month period. The Laughing dove occurs in pairs, however, during foraging it was found in groups of 4 to 6 birds at many places. When birds were found in a small group then we counted it as a single observation.

## Results

The average species density in the study area was 40 birds/km<sup>2</sup>. The Laughing doves were seen feeding on grass seeds *Cynodon dactylon* and *Andropogon muricatus* (20% observations). A total of 10 species of weeds belonging to 9 families, whose seeds they were noted foraging (22% observations) is listed Tab. 2. Among the weed seeds maximum observations were on *Solanum nigrum* (4%), *Amaranthus spinosus* (3%) and *Euphorbia thymifolia* (3%). They were seen foraging grains of wheat *Triticum aestivum* (25% observations); millets *Sorghum vulgare* and *Pennisetum typhoides* (20% observations); rice *Oryza sativa* (5% observations); and *Helianthus annuus* seeds (8% observations). Their foraging activities were affected by seasonal changes. During summers birds fed early in the morning (average species density: 50 birds / km<sup>2</sup>) and avoided hot afternoons (average species density: 8 birds/ km<sup>2</sup>). However, prior to sunset the foraging activities picked momentum (average species density: 15 birds/ km<sup>2</sup>). In winters the doves continued throughout the day with maximum foraging during afternoon (average species density: 48 birds/ km<sup>2</sup>).

Among foraging observations on insects we recorded just 80 observations which included small sized insects that is ants: *Camponotus* sp (35% observations); dipteran larvae (25% observations); termites: *Odontotermes* sp. (20% observations); spiders: *Cteniza* sp. and *Lycosa* sp. (20% observations).

They ate rice and consumed its grains. At times they picked grains shed on ground during harvesting period (15 observations). *Sorghum vulgare* was eaten by Laughing doves at the ripening stage. The Laughing doves fed on *Sorghum vulgare* grains in the presence of blue rock pigeons (*Columba livia*), who were also seen depredating the crop. Fields with *Pennisetum typhoides* crop were heav-

**Table 1.** List of weeds whose seeds were identified in gut contents of laughing doves in Lucknow, India – *Lista delle piante infestanti identificate nei contenuti dei gozzi di tortore delle palme, Lucknow, India.*

Name	Family	Percentage
<i>Chenopodium album</i>	Chenopodiaceae	2.5
<i>Argemone mexicana</i>	Papaveraceae	1.4
<i>Amaranthus spinosus</i>	Amaranthaceae	3.2
<i>Amaranthus viridis</i>	Amaranthaceae	2.8
<i>Solanum nigrum</i>	Solanaceae	3.4
<i>Eclipta prostate</i>	Asteraceae	1.0
<i>Euphorbia thymifolia</i>	Euphorbiaceae	2.0
<i>Setaria verticillata</i>	Poaceae	2.0
<i>Boerhaavia diffusa</i>	Nyctaginaceae	3.3
<i>Cyperus rotundus</i>	Cyperaceae	1.6

**Table 2.** List of weeds whose seeds were foraged by brown doves in fields, Lucknow, India – *Lista delle piante infestanti dei cui semi si sono alimentate le tortore delle palme, presso Lucknow, India.*

Name	Family	Percentage
<i>Chenopodium album</i>	Chenopodiaceae	2
<i>Argemone mexicana</i>	Papaveraceae	2
<i>Amaranthus spinosus</i>	Amaranthaceae	3
<i>Amaranthus viridis</i>	Amaranthaceae	2
<i>Solanum nigrum</i>	Solanaceae	4
<i>Eclipta prostate</i>	Asteraceae	2
<i>Euphorbia thymifolia</i>	Euphorbiaceae	3
<i>Setaria verticillata</i>	Poaceae	2
<i>Indigofera tinctoria</i>	Leguminosae	1
<i>Leucas aspera</i>	Labiatae	1

ily eaten by doves at ripening stage. It was observed in summers (April to October) that the doves fed early in the morning and avoided the hot hours during afternoon (70 observations). During winters (November to March) they fed throughout the day, even during afternoons (80 observations). They quickly learnt from experience where and how food might be obtained; hence they remembered to visit an abundant source of supply. They visited farms and grain-houses several times spanning weeks, after their first visit there, a fact corroborated by the local people (25 observations).

Roosting sites played a vital role in the foraging behaviour of these birds. It was observed that wherever there were electricity and telephone wires and vegetation cover in the vicinity, which served as roosting sites for them, their visits were much more in the fields nearby, as compared to fields without electric wires and dense vegetation cover around them (40 observations). Average species density went up to 60 birds/ km<sup>2</sup> in 1 km<sup>2</sup> area around roosting sites. These birds were not deterred from foraging by the presence of other birds like flocks of blue rock pigeons and house sparrows (30 observations); they even shared common roosting sites with them (50 observations). However, during the nesting period (January to October) these birds had to attend to nest construction, incubation and protecting the fledglings; areas of 1 km<sup>2</sup> near the nest-sites witnessed more foraging activities by nesting Laughing doves than those away from the nesting sites during the nesting period. During this period nesting Laughing doves were seen foraging individually and never in small groups or pairs since one parent dove would always remain in the nest. They would return to their nests in short intervals to take care of hatchlings. The nesting

doves were observed outside their nests for foraging and other activities every time for 10-15 mins only (80 observations). Young birds required time to learn the foraging skills; young Laughing doves were seen picking grains from the ground and releasing them immediately without swallowing them (50 observations). This was in sharp contrast to the older doves that recognized their food immediately.

It was observed that only those fields of wheat were attacked by these birds, which due to early sowing matured earlier than the crops in the surrounding areas. Such fields had average species density of 45 birds/ km<sup>2</sup> as against 15 birds/ km<sup>2</sup> in wheat fields sown late. This damage to crops can easily be prevented by avoiding very early sowing of these crops, as sowing crops in all areas at the same time would make them reach the maturity stage synchronously. Only about 2 m broad strips of wheat adjoining the sugarcane fields were heavily damaged whereas the remaining portions underwent less damage. This happened when sugarcane was harvested in time to prevent the sugarcane fields to provide shelter to Laughing doves. The presence of bristles and awns in millets desisted these doves from feeding on them. Their number in such fields was much less as compared to millets without awns and bristles with average species density of 8 birds/ km<sup>2</sup> and 30 birds/ km<sup>2</sup>, respectively.

At storehouses and granaries for grains the Laughing doves, using their beaks tried to tear open grain filled sacs at weak points along with blue rock pigeons (10 observations). This made the grains pour out of sacs onto the ground causing a large number of birds to congregate and start picking the grains. Four unprotected storehouses and granaries where birds could come unrestricted were sub-

jected to enormous crop damage. We counted 80-100 doves within a 150 m radius area. This was in sharp contrast to protected granaries and storehouses where a few measures had been put in place such as iron grills in windows to deter birds. During transport of grain filled sacs from storehouses and granaries to grain markets, these birds picked grains from the weak points of the unprotected sacs, which they opened with their beaks (12 observations). Much in the same way, in the grain markets these birds ate the unprotected grain heaps. At flourmills the Laughing doves invaded cans having grains, which were kept open before the grains were poured into the flourmill (16 observations). At several flourmills these birds along with other birds such as blue rock pigeons and house sparrows picked grains before threshing (8 observations). We counted 45-50 Laughing doves in and around each protected granary and storehouse of grains on city outskirts, however, their number was 25-30 in grain markets in the city.

## DISCUSSION

The study done by us assumes significance since very less is known about the feeding and foraging behaviour of the Laughing doves in India. From the study we concluded that these birds feed on grains of rice, wheat, millets and seeds of grass, weeds and sunflower along with insects. The gut content analysis was largely corroborated by the field study done on the foraging behaviour of these doves on the city outskirts and in and around the granaries and storehouses in Lucknow city.

The type of food consumed by birds is economically, fundamentally and ecologically important (Kendeigh 1975). Availability of food plays an important role in diet of a bird species and a species can enjoy some flexibility in food choices as we have seen in the present study with the Laughing doves consuming grains, weed-seeds and arthropods. A stenophagous species (parrots, hawks, pelicans, etc.), that depends on restricted food sources, increases perfection of its feeding adaptations and reduces or may eliminate competition with other species for its special food. Euryphagous species (doves, crows, red whiskered bulbuls, etc.) eat a variety of food items (Mayand 1950). Conway and Martin (2000) suggested that environments with high predation risk may favour long periods in the nests and a few foraging trips. Nest attentiveness during incubation represents a parent-off-spring conflict wherein

incubating birds must balance a trade-off between caring for embryos by staying in nests and caring for themselves by going out to forage. This was perhaps why the Laughing doves, during the present study, chose to make short-duration trips for foraging during nesting season. The amount of food consumed by a bird depends on species, health, age and sex, season, time of day, food availability and other factors. According to Welty (1964) the volume of food eaten per day varies with type of food, as a general rule birds eat most heavily in early morning and again late in afternoon, logical times in view of overnight fast. This fact was true in the present case as the Laughing doves fed early in the morning and late in afternoon during summers to avoid the hot weather. According to Singh and Kumar (1982) seed-eaters having short and heavy beaks consume seeds and grains using powerful jaw muscles which seems to be true in the present study since the Laughing doves have short beaks.

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